

Empirical Ionospheric Model Based on Saint Santin Incoherent Scatter Radar Data







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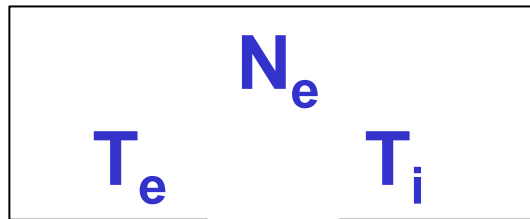
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Background Information

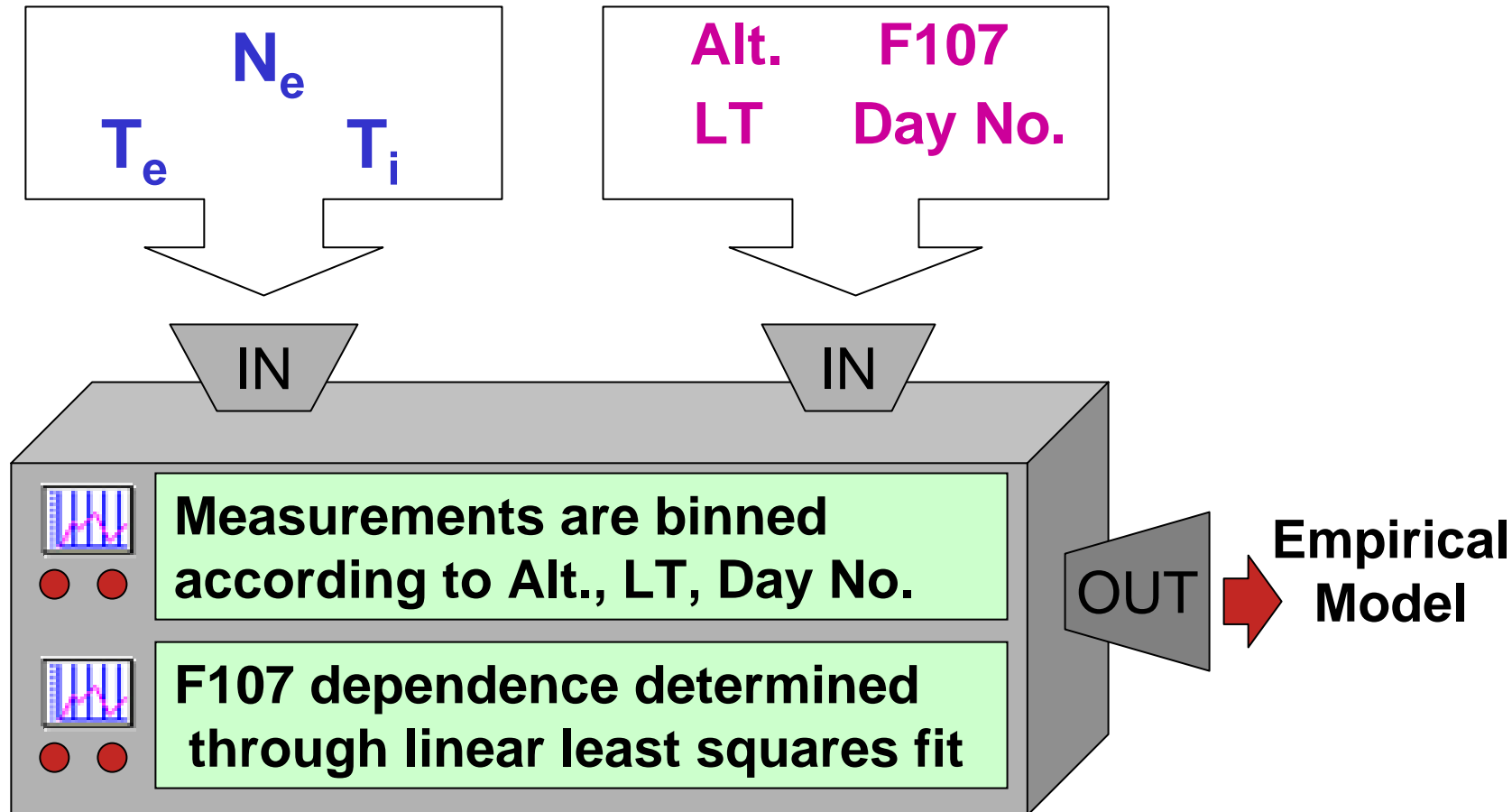
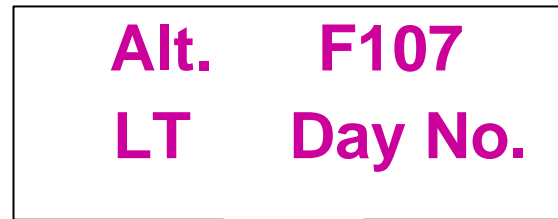
-  Ionospheric data recorded by the bistatic incoherent scatter radar at **St. Santin, France** (45-47°N c.f. 54°N for Millstone)
-  Data obtained from the **CEDAR/MADRIGAL** database
-  Data spans the years **1966** through **1987**
-  **Model** used originally developed for **Millstone Hill** data

Building a Model

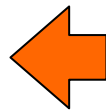
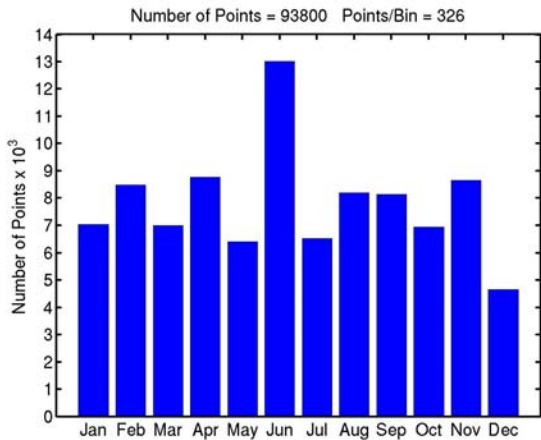
We measured...



With the corresponding...

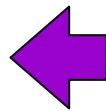
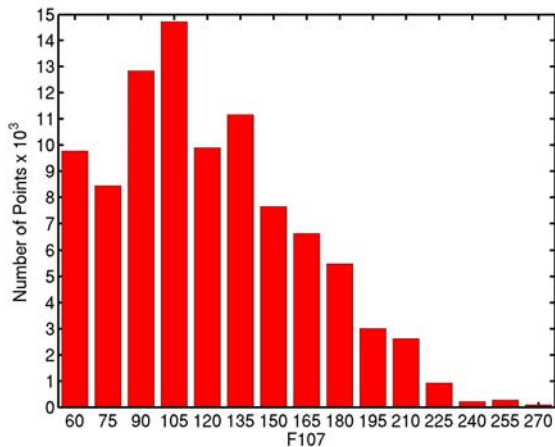
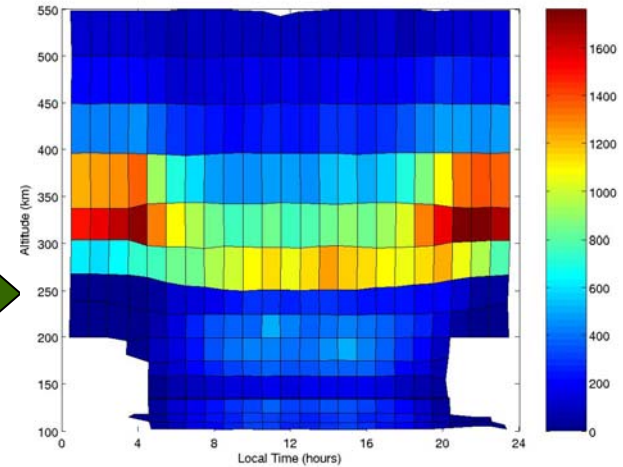
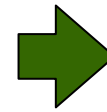


Investigating the Data Distribution



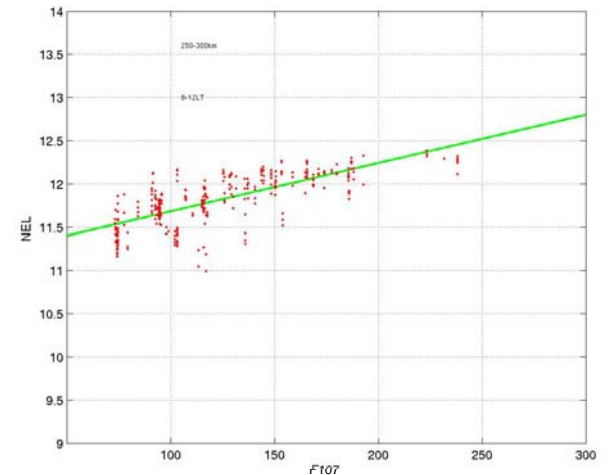
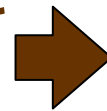
Number of points per month

Number of points per altitude and LT

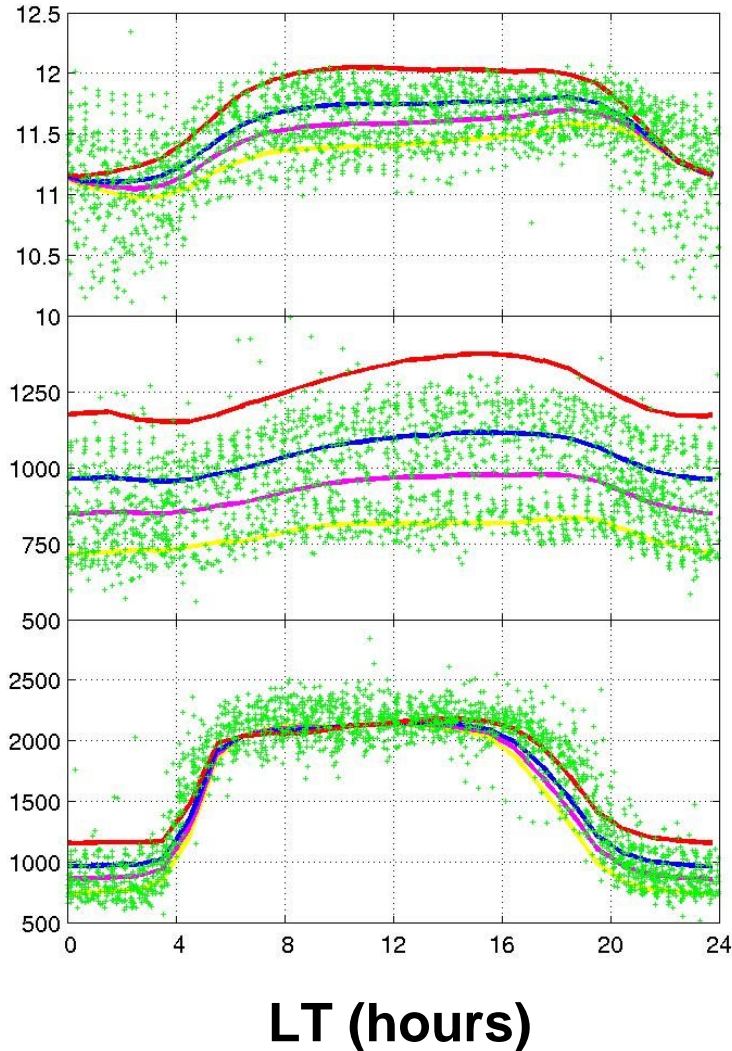


Number of points per F107

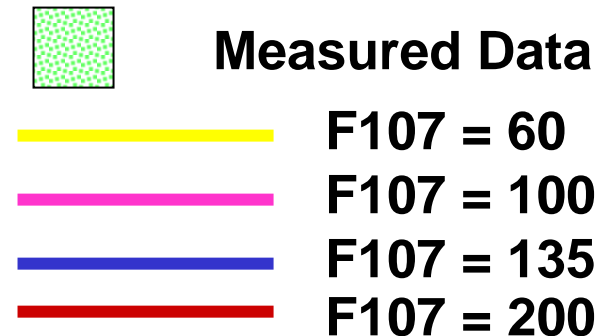
Check if linear fit is good for F107



Data and Model Profiles



- Check how well measured data and model data match
- Here we plot each parameter vs. LT for Day No. = 184 and Alt. = 275

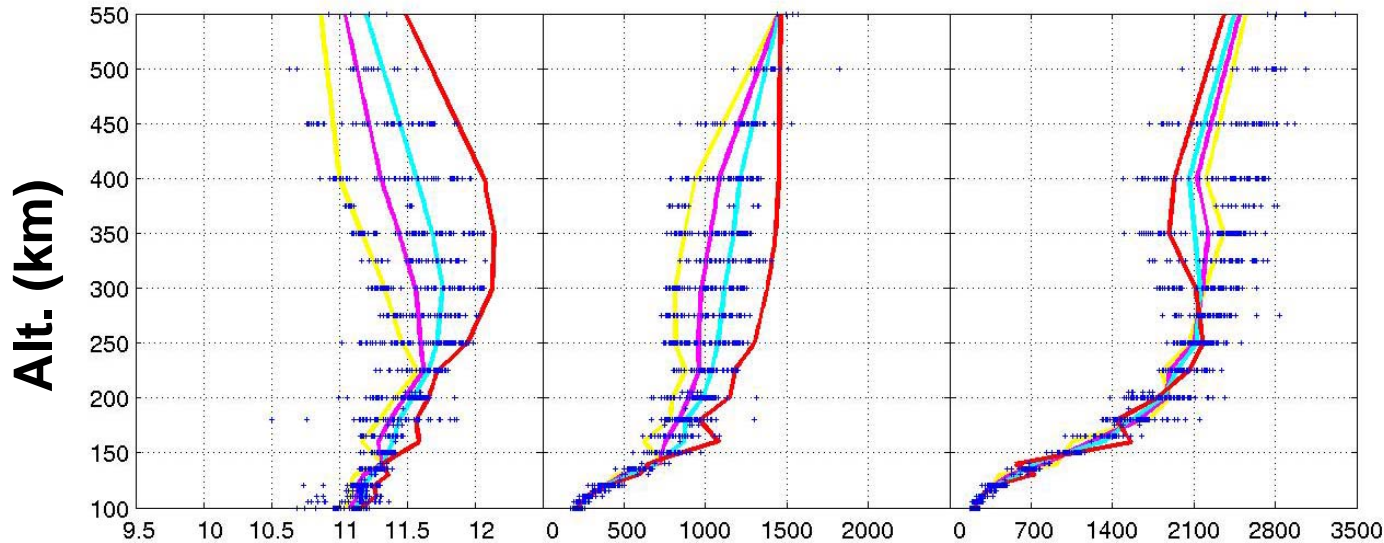


Data and Model Profiles

$\log(N_e)$

T_i

T_e



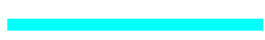
Measured Data



F107 = 60



F107 = 100



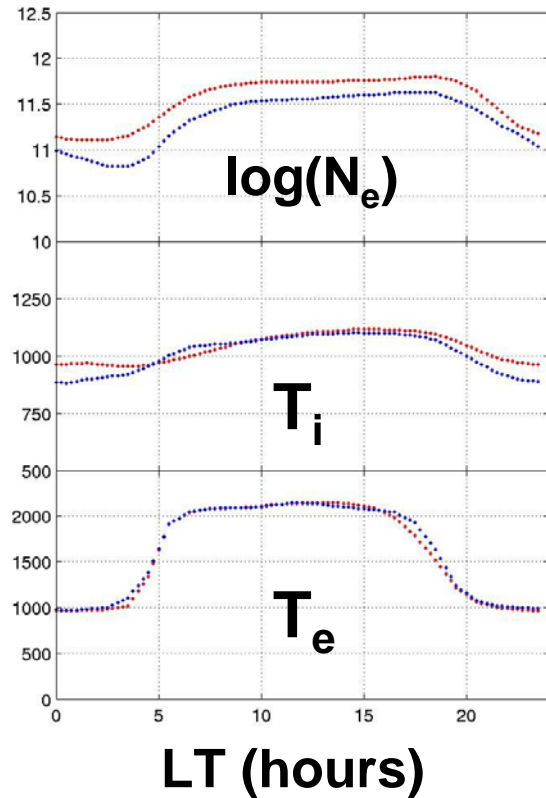
F107 = 135



F107 = 200

- Here we plot Alt. vs. each parameter for LT = 12 and Day No. = 184
- The limits of the F107 range should be at the edges of the data respectively

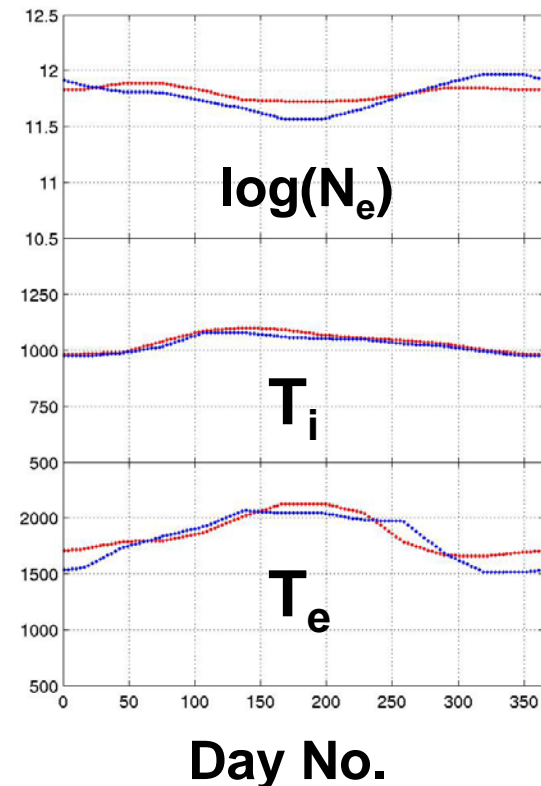
Millstone Hill Vs. St. Santin



Day No. = 184
Alt. = 275 km
F107 = 135

- Each model created using essentially the same software—do they produce similar outputs?
- Models match reasonably well
- St. Santin tends to vary less than Millstone and produce quantitatively higher N_e outputs

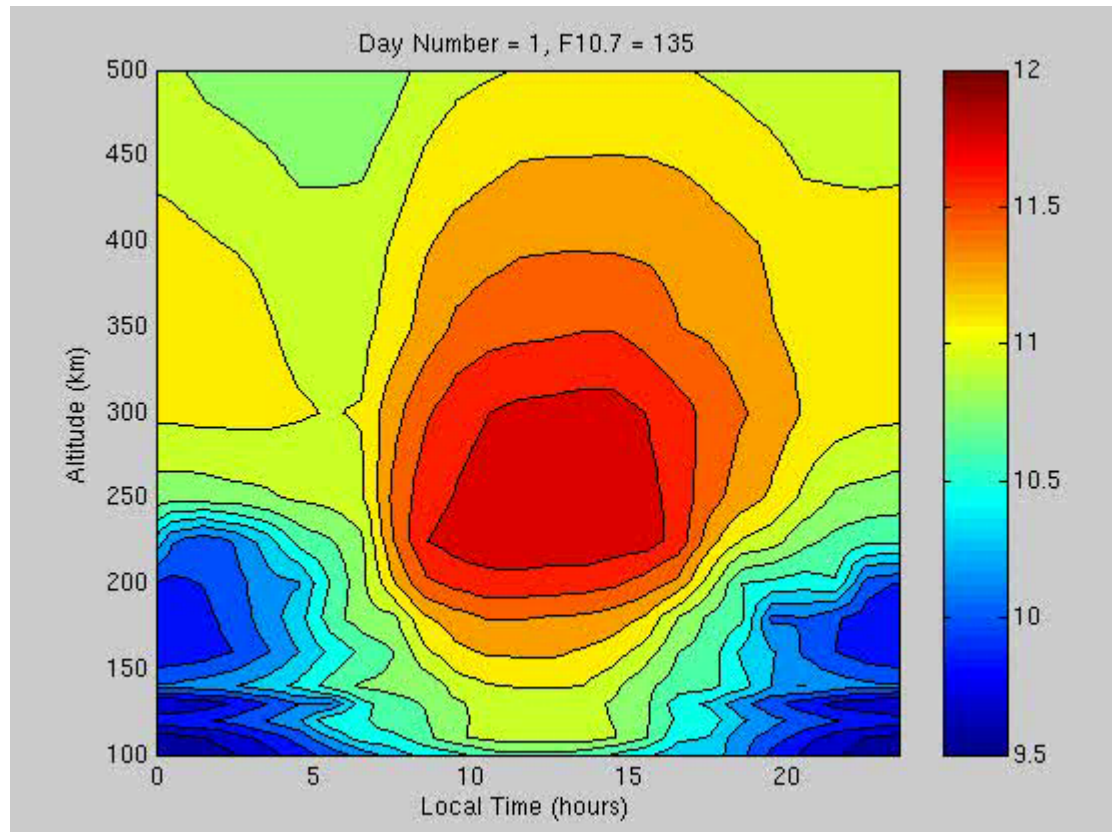
LT = 12 hours
Alt. = 250 km
F107 = 135



Movies allow us to view multiple parameters at once



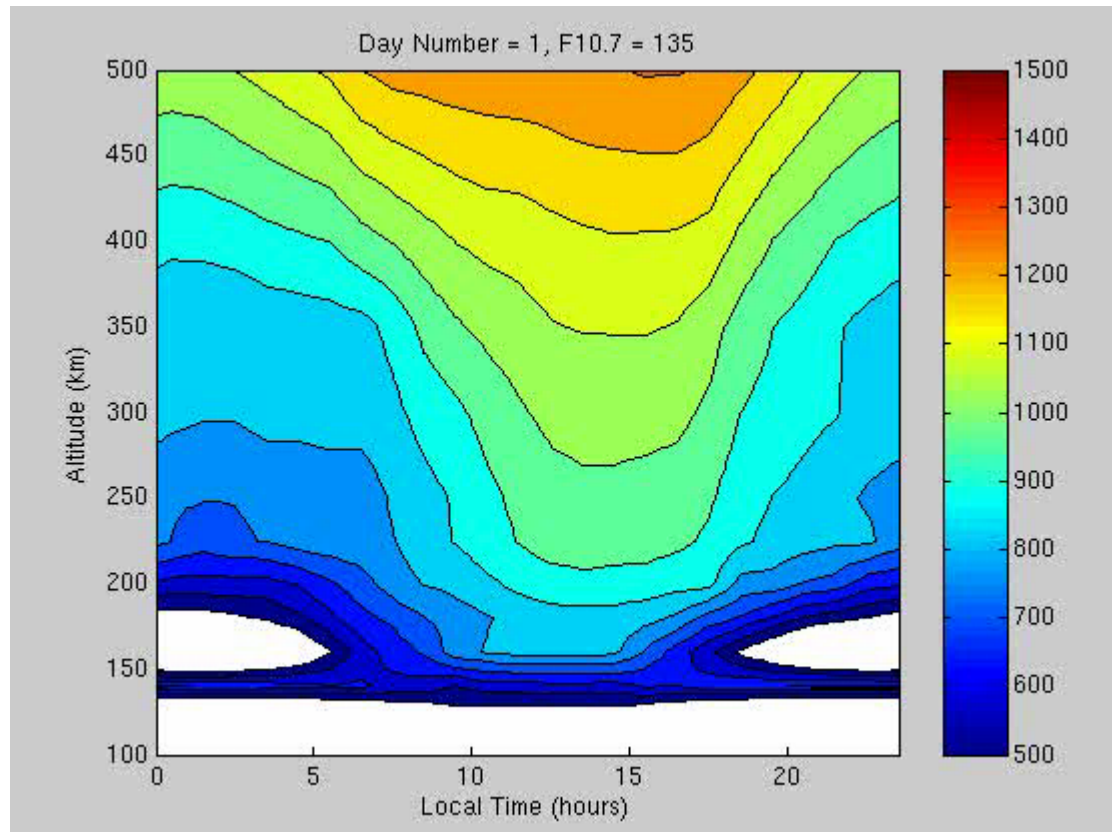
$\log(N_e)$: Alt. vs. LT, progressing over Day No., F107 = 135



Movies allow us to view multiple parameters at once



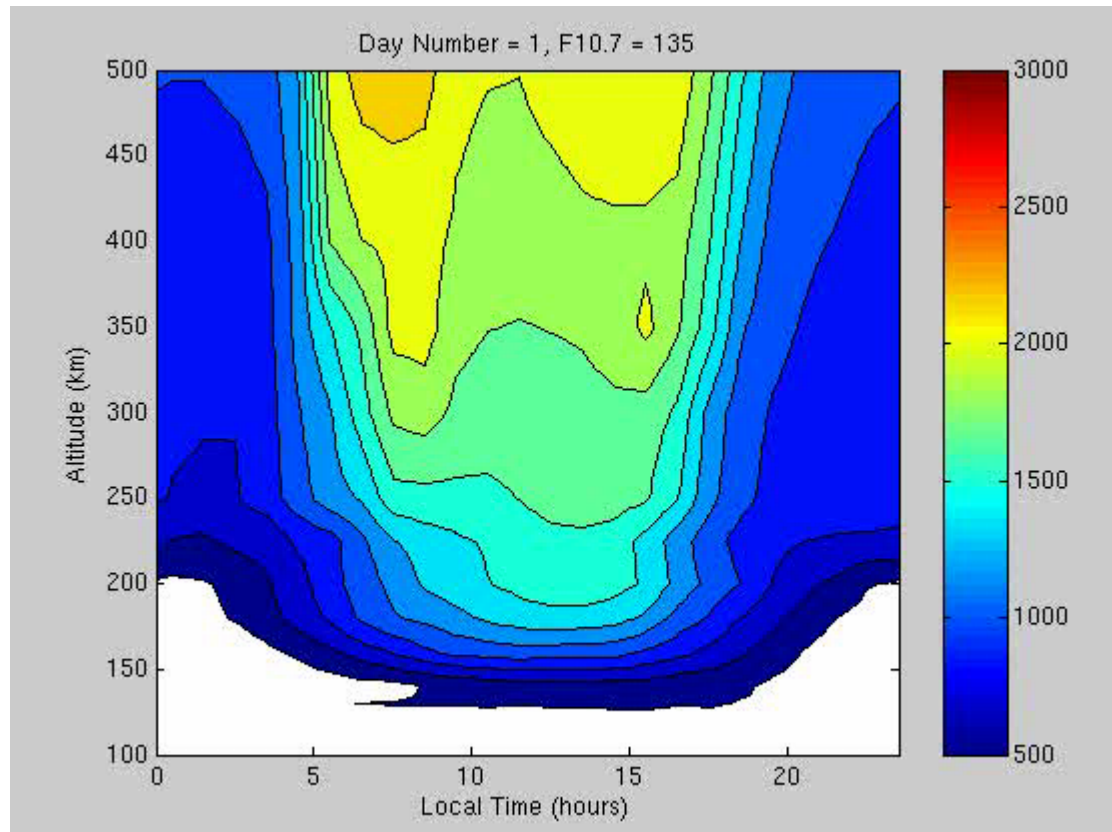
T_i: Alt. vs. LT, progressing over Day No., F107 = 135



Movies allow us to view multiple parameters at once



T_e : Alt. vs. LT, progressing over Day No., F107 = 135

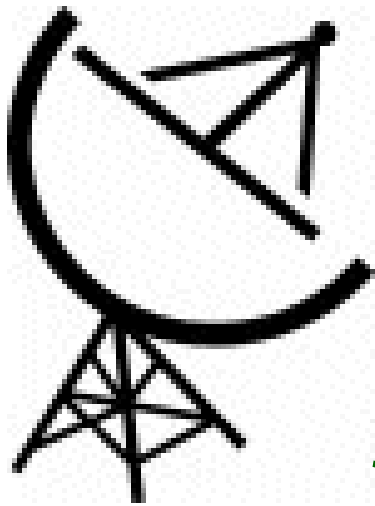


The Virtual St. Santin Radar

-  **Calculates predicted ionospheric conditions at the current time**
-  **Updated every 15 minutes**
-  **<http://www.haystack.mit.edu/madrigan/vssr>**

Conclusion

The Saint Santin Empirical Model produces reasonable results with respect to both the measured data and the Millstone Hill Empirical Model.



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